EXHIBIT A

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Vallotton

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(54) **FOLDING KNIFE HAVING A BIASED BLADE**

(75) Inventor: **Alney K. Vallotton**, Oakland, OR (US)

(73) Assignee: **The Great American Tool Company Inc.**, Buffalo, NY (US)

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(51) **Int. Cl.**
B26B 1/04 (2006.01)

(52) **U.S. Cl.** **30/159**; 30/160

(58) **Field of Classification Search** 30/160, 30/161, 159
See application file for complete search history.

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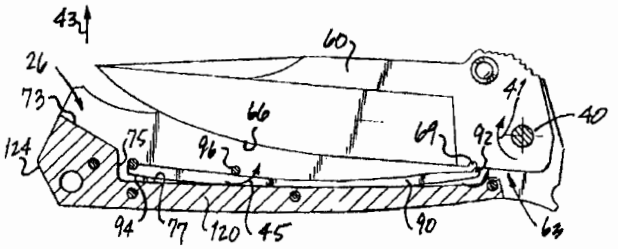
Primary Examiner—Charles Goodman
(74) *Attorney, Agent, or Firm*—Darby & Darby

(57) **ABSTRACT**

A folding knife according to one embodiment is provided and includes (a) a handle defining a blade cavity; (b) a blade having a first end which is pivotably coupled to the handle about a pivot; and (c) a biasing element disposed within the blade cavity of the handle. The blade has a detent formed therein on a lower edge thereof proximate to the pivot. The biasing element has a fixed first end and an opposing free second end which has a rounded ball member formed thereat. As the blade is closed towards the retracted position, the blade contacts and deflects the second end of the biasing element until the rounded ball member of the second end engages the blade detent, resulting in the blade being held in the retracted position. As the blade is pivotably opened, the rounded ball member of the second end disengages from the detent and energy stored in the deflected biasing element is released and directed into a biasing force against the blade causing the blade to pivot towards the extended position, thereby assisting a user in opening the blade.

25 Claims, 4 Drawing Sheets



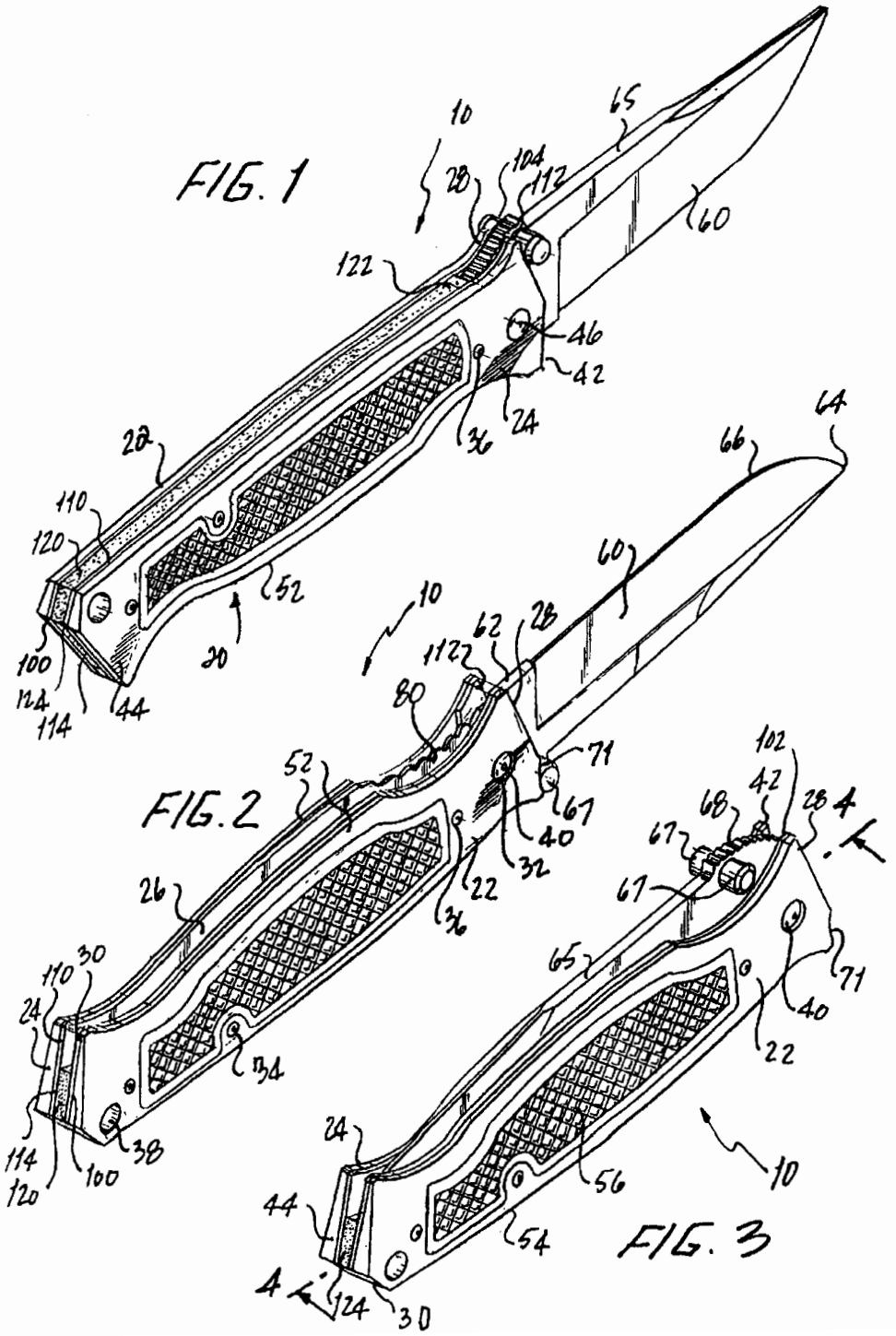
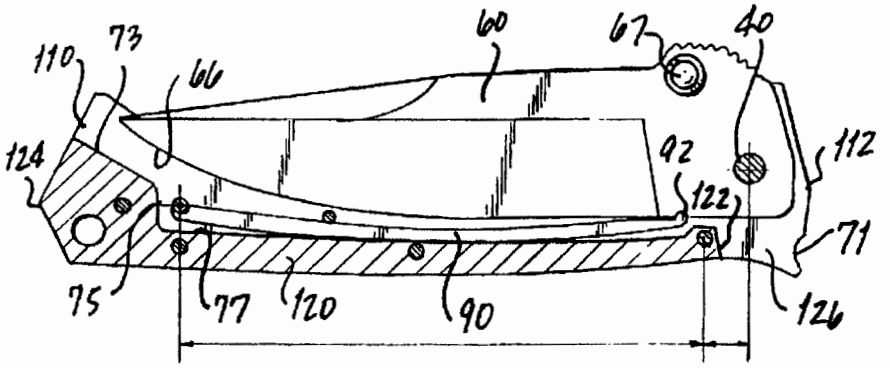


FIG. 1

FIG. 2

FIG. 3

FIG. 4



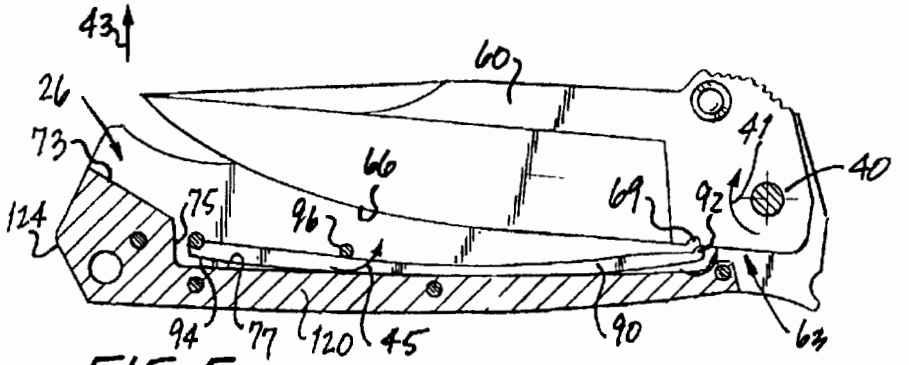


FIG. 5

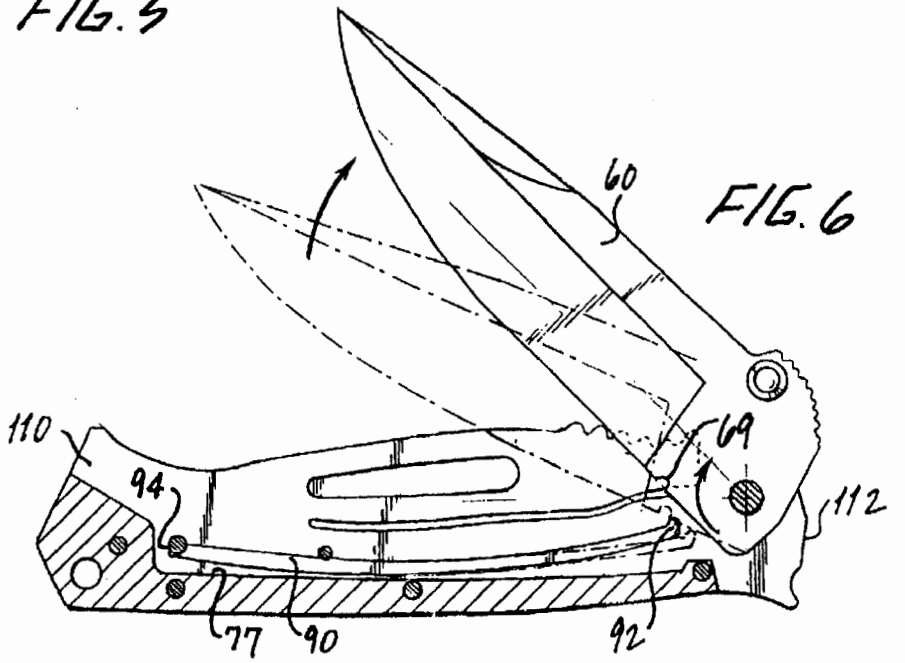


FIG. 6

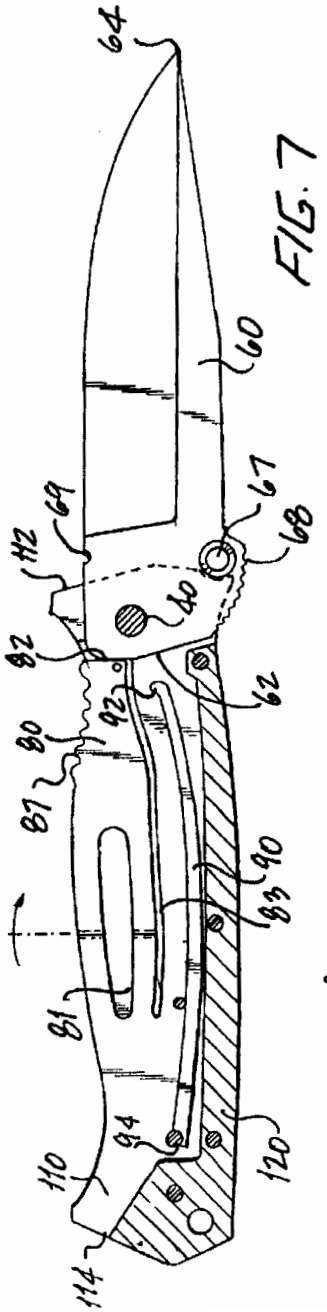

64
60
67
68
69
112
40
82
92
62
80
87
90
93
81
94
110
120
114

FIG. 7

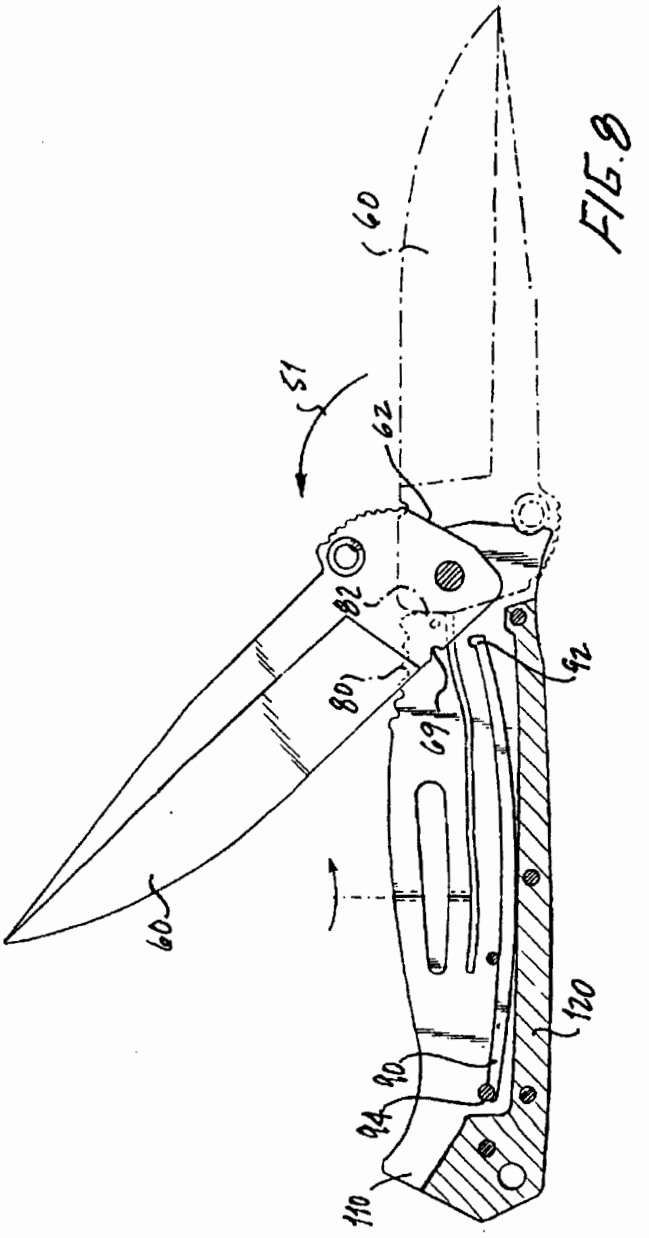

60
51
62
82
92
80
69
60
120
90
94
110

FIG. 8

FIG. 9

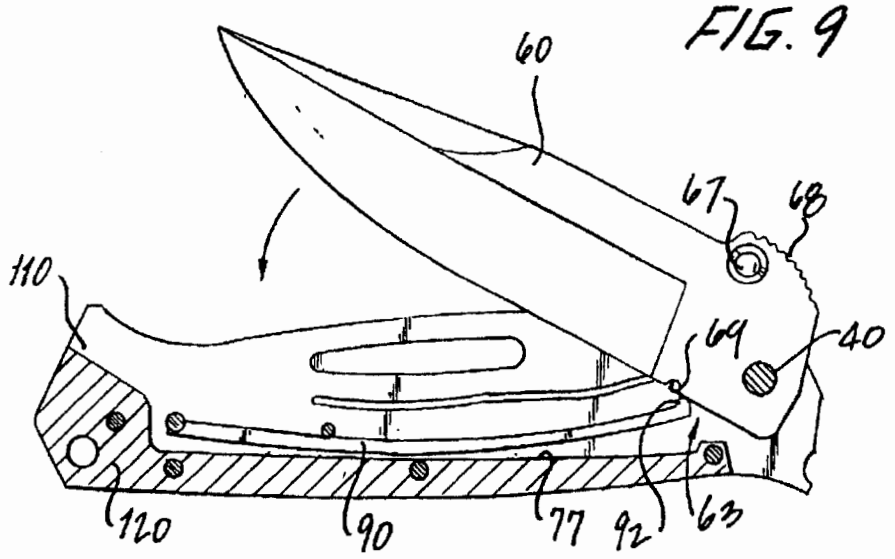


FIG. 10

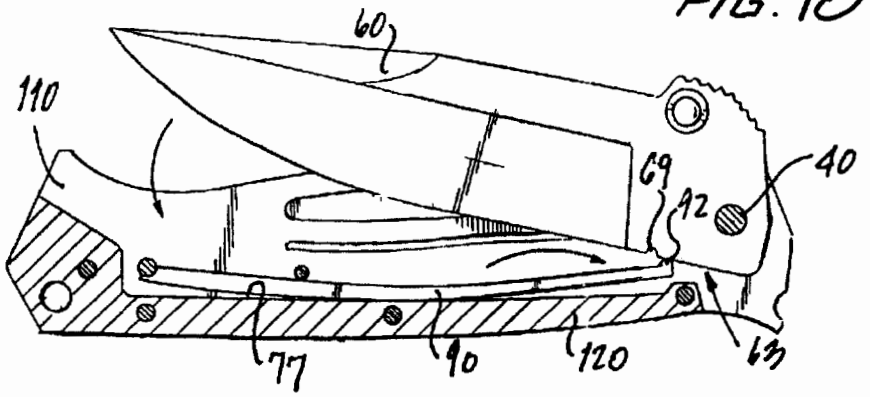
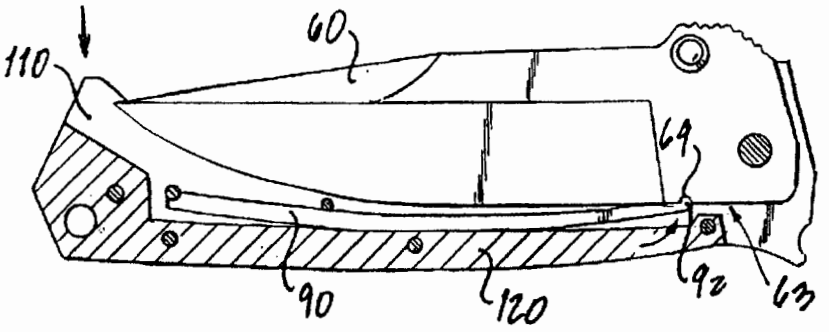


FIG. 11



FOLDING KNIFE HAVING A BIASED BLADE

TECHNICAL FIELD

The present invention relates generally to a folding knife and more particularly, relates to a knife having a biasing element for assisting the user in extending a blade of the knife.

BACKGROUND

A knife is a sharpened instrument typically having a handle portion and a blade. In knives which are not of the foldable or retractable type, the blade permanently extends outwardly from the handle and the knife is stored in a case or the like. Another type of knife is a foldable knife in which the position of the blade may be varied. Folding knives are an attractive option as these types of knives typically permit the blade to be conveniently and safely carried on a person's body (e.g., in a pocket of pants or a jacket) or in a member that is carried by the person (e.g., tackle box, backpack, toolbox, etc.) as well as permitting the knife to be safely stored at a location removed from the person (e.g., drawer, etc.). In many folding knife designs, the blade is positionable between an open position where the blade is extended and a closed position where the blade is retracted into the knife's handle.

A locking mechanism which is part of the handle permits the blade to be locked in the open position as well as the closed position so that the blade cannot freely move and extend from the handle. Folding knives with blades which automatically lock are desirable for safety purposes in that the blade is prevented from closing on the person's hand or fingers during use. However, there may be times when it is not desirable to have the blade locked in the open position, for example, when using the blade for performing a simple task, such as cutting a piece of string or tape or opening a container, like a box. In such situations, closure of the blade would not require the separate deactivation of a blade locking member, which may be the case had the blade been locked.

One of the disadvantages of conventional folding knives is that the task of opening and extending the blade can be a difficult task for some users. For example, this task can require significant pulling force to extract the blade from the folding knife housing. For some users, this is a difficult task and also presents the possibility that the user may become injured while exerting great effort in retracting the blade.

Thus, it would be desirable to provide a folding knife having means for allowing the user to readily open the blade, even when the user is wearing gloves or in situations where the user's hand is disabled to an extent which limits the mobility of the user's fingers in grasping and extracting a conventional blade from a folding knife.

SUMMARY OF THE INVENTION

A folding knife is provided and includes (a) a handle defining a blade cavity; (b) a blade having a first end which is pivotably coupled to the handle about a pivot; and (c) a biasing element disposed within the blade cavity of the handle.

The blade pivots about the pivot between a retracted position where the blade is substantially within the blade cavity and an extended position where the blade is substantially outside of the blade cavity. The blade has a detent formed therein on a lower edge thereof proximate to the pivot. The biasing element is disposed within the blade cavity of the handle. The biasing element has a fixed first end and an opposing free second end which has a rounded ball member formed thereat. As the blade is closed towards the retracted position, the blade contacts and deflects the second end of the biasing element until the rounded ball member of the second end engages the blade detent, resulting in the blade being held in the retracted position due to a contact force being generated between the rounded ball member and at least one surface of the detent. As the blade is pivotably opened, the rounded ball member of the second end slides out of engagement with the detent and energy stored in the deflected biasing element is released and directed into a biasing force against the blade causing the blade to pivot towards the extended position, thereby assisting a user in opening the blade.

Other features and advantages of the present invention will be apparent from the following detailed description when read in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing and other features of the present invention will be more readily apparent from the following detailed description and drawings of illustrative embodiments of the invention in which:

FIG. **1** is a top perspective view of a folding knife according to an exemplary embodiment with a blade of the knife being in an extended position;

FIG. **2** is a bottom perspective view of the folding knife of FIG. **1**;

FIG. **3** is a bottom perspective view of the folding knife of FIG. **1** with the blade of the knife being in a retracted position;

FIG. **4** is a cross-sectional view of the folding knife of FIG. **3** taken along the line **4**—**4**;

FIG. **5** is a cross-sectional view of the exemplary folding knife with the blade in a first intermediate position;

FIG. **6** is a cross-sectional view of the exemplary folding knife with the blade in a second intermediate position;

FIG. **7** is a cross-sectional view of the exemplary folding knife with the blade being in an extended position;

FIG. **8** is a cross-sectional view of the exemplary folding knife with the blade being moved to a first intermediate position as the user closes the blade;

FIG. **9** is cross-sectional view of the exemplary folding knife with the blade being further closed to a second intermediate position with the blade contacting a biasing element of the knife;

FIG. **10** is a cross-sectional view of the exemplary folding knife with the blade being further closed to a third intermediate position with the biasing element being deflected; and

FIG. **11** is a cross-sectional view of the exemplary folding knife with the biasing element being further deflected and in engagement with the blade.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring first to FIGS. **1** through **3**, a biased folding knife according to one exemplary embodiment is generally indicated at **10**. The folding knife **10** includes a handle portion **20**, a blade **60**, a locking feature **80**, and a biasing element **90** (FIG. **4**) for assisting the user in extending the blade **60** from a retracted position to an extended position.

The handle portion **20** is formed of several components including a first outer handle member **22** and an opposing

second outer handle member **24**, which preferably are mirror images of one another. The first and second handle members **22**, **24** can be formed from any number of suitable materials, including plastics (e.g., fiber reinforced plastics), metals, etc. The handle portion **20** also includes a first inner handle support plate **100** adjacent the first handle member **22**, an opposing second inner handle support plate **110** adjacent the second handle member **24** and a handle core **120** disposed between the first and second handle plates **100**, **110**, which are all preferably formed of metal.

When these handle components are attached to one another, a blade cavity **26** is defined between the first and second inner handle plates **100**, **110** and above the handle core **120**. The blade cavity **26** is configured to carry the blade **60**. The first handle member **22** includes a first end **28** and an opposite second end **30**. At the first end **28**, an opening **32** is formed for receiving a pin **40** about which the blade **60** pivots as will be described in greater detail hereinafter.

The first handle member **22** also includes a number of openings **34** formed therein which receive fasteners **36** for securely connecting the handle components. For example, screws **36** can be inserted into the openings **34** and used to attach the various handle component to one another. At the second end **30**, an opening (bore) **38** is formed in the first handle member **22**. The opening **38** can be used to receive a cord or the like to permit the folding knife **10** to be easily worn or hung.

The first inner handle plate **100** is attached to first handle member **22** and preferably is similarly or identically shaped thereto. The first handle plate **100** includes a first end **112** which aligns with the first end **28** and a second end **114** which aligns with the second end **30**. A notch **71** is formed at the first end **112**. The first inner handle plate **100** receives the fasteners **36**, thus securely attaching the first handle member **22** to the first inner handle plate **100** and also receives the pin **40** for permitting the pivoting movement of the blade **60**. The first handle plate **100** defines an upper side wall of the blade cavity **26**.

The second handle member **24** is preferably a mirror image of the first handle member **22**. The second handle member **24** includes a first end **42** and an opposing second end **44** with the first end **42** being spaced from first end **28** and the second end **44** being spaced from the second end **30**. At the first end **42**, an opening **46** is formed and is axially aligned with the opening **32** so that the pin **40** extends across the handle components with the blade **60** pivoting about the pin **40**. The second handle member **24** also contains openings to receive fasteners **36** so as to attach the second handle member **24** to the second inner handle plate **110** as well as other handle components. An opening **38** is formed at the second end **44** for forming the bore that extends through the second ends **30**, **44** as well as through the first and second inner handle plates **100**, **110** and the core **120**.

The second handle plate **110** is disposed adjacent the second handle member **24** and includes a first end **112** which aligns with the first end **42** and a second end **114** which aligns with the second end **44**. The first end **112** has a notch **71** formed therein.

The core **120** is preferably a metal core member that extends substantially the length of the folding knife **10**. As best shown in FIG. **1**, the core **120** has a first end **122** that is orientated near the first ends **28**, **42** of the first and second handle member **22**, **24** and an opposing second end **124** that preferably aligns with the second ends **30**, **44**. The first end **122** does not align with the first ends **28**, **42** but rather terminates prior to the first ends **28**, **42** so that a space **126** (FIG. **4**) is formed. The space **126** is designed to permit the blade **60** to pivot into and out of the blade cavity **26** as the blade cavity **26** is formed above the core **120**. The core **120** is described in greater detail hereinafter with reference to later figures.

Each of the first and second handle members **22**, **24** includes a contoured upper edge **52** and an opposing contoured bottom edge **54**. An outer surface of each of the first and second handle members **22**, **24** can contain a roughened portion **56** which serves as a gripping portion to assist the user in grasping and holding the folding knife **10**. This is particularly helpful when the folding knife **10** is used in less than ideal conditions, such as wet conditions due to rain or the knife **10** being used near a wet environment.

The blade **60** includes a first end portion **62** and a second, tipped portion **64** substantially opposite the first end portion **62**. A sharpened cutting edge **66** is provided on blade **60** as part of a lower surface **63** thereof. Opposite the lower surface **63** is an upper surface **65** which includes ridges **68** formed at the first end portion **62**. Preferably, the ridges **68** are formed on a curved portion of the upper surface **65** that extends from the first end to a location close to the first end. The ridges **68** act as a thumb engaging portion to which the user applies a force using his/her thumb to cause the blade **60** to close from the extended position. The blade **60** also has a pair of opposing pins **67** that are formed near the inner section of the ridges **68** and protrude outwardly from planar surfaces of the blade **60**. The pins **67** are preferably axially aligned with one another and are circular members. Optionally, the pins **67** include a roughened peripheral surface to facilitate a gripping action between the user and the pins **67**.

The pins **67** also serve as stoppers that limit the range of the extension of the blade **60**, as shown in FIGS. **1** and **2**. When the blade **60** is fully extended, the pins **67** engage ends **28**, **42** of each of the first and second handle members **22**, **24**, respectively, as well as ends **102**, **112** of the first and second handle plates **100**, **110** so as to limit the angle that the blade **60** can extend. As shown in FIG. **3**, the ends **28**, **42** preferably include a section **71** that is complementary to both the dimensions and the shape of the pins **67**. When the blade **60** is fully extended, the pins **67** seat within the sections **71**, each of which in the exemplary embodiment is an arcuate notch which mates with the circular pins **67**. The notches **71** of the first and second handle members **22**, **24** are complementary to and in alignment with the notches **71** of the first and second handle plates **100**, **110** to provide notched grooves that receive pins **67**.

When the blade **60** is fully retracted, the pins **67** are disposed above the upper edges **52** of the first and second handle members **22**, **24**. Preferably, the section of each upper edge **52** that is generally below each pin **67** when the blade **60** is fully retracted has a curved profile so as to permit the user to insert his/her fingers under the pins **67**, thereby permitting the user to exert pressure on the pins **67** and push the blade **60** into an open position, as will be described in greater detail later. In the fully retracted position, a length of the upper surface **65** of the blade **60** will likely extend above the upper edges **52** of the first and second handle members **22**, **24**.

FIGS. **4** through **7** illustrate the operation of opening the blade **60** from the fully retracted position of FIG. **4** to the fully extended position of FIG. **7**. FIG. **4** is a cross-sectional view taken along the line **4**—**4** of FIG. **3** and illustrates the core **120** in cross-section. As illustrated in FIG. **4**, the second end **124** of the core **120** has a beveled edge **73** that is

disposed below the sharped cutting edge **66** at the second, tipped end portion **64**. A shoulder **75** is formed at one end of the beveled edge **73** and leads down to a generally planar lower surface **77**, which defines in part the blade cavity **26**.

The biasing element **90** of the folding knife **10** is disposed in the blade cavity **26** between the first and second handle plates **100**, **110**. The biasing element **90** has a first end **92** and an opposing second end **94**. The second end **94** is fixed in place as by a fastener or the like which attaches to at least the first and second handle plates **100**, **110** (FIG. **1**) and may further be attached to the first and second handle members **22**, **24** (FIG. **1**). However, it will be understand that any number of means can be used to fix the second end **94** in place. The first end **92** is in the form of a ball end such that the first end **92** has an arcuate shape and forms an arcuate transverse ridge. The biasing element **90** extends across the blade cavity **26**, generally above the planar lower surface **77**. The movement of the biasing element **90** is held in place by a pin **96** that is disposed along the length of the biasing element **90** between the first and second ends **92**, **94**. The biasing element **90** is thus held in place and its range of deflection is limited by disposing the biasing element **90** between the planar lower surface **77** and the pin **96**. Preferably, the pin **96** is disposed closer to the attached second end **94** as compared to the first end **92**.

According to the illustrated exemplary embodiment, the lower surface **63** of the blade **60** contains a detent **69** formed therein near one end of the sharpened cutting edge **66**. The detent **69** is in the form of a notch cut into the blade **60**. The exemplary detent **69** has a generally semi-circular shape. In other words, the shape of the detent **69** is complementary to the shape of the first end **92** of the biasing element **90** and therefore, according to the exemplary embodiment, the semi-circular detent **69** is sized and shaped to receive the arcuate ridge that defines the first end **92**.

FIG. **4** shows the blade **60** in a retracted position. In this position, the biasing element **90** assumes a deflected position as the closing of the blade **60** causes the first end **92** to be deflected towards the planar lower surface **77**. In this retracted position, the arcuate ridge at the first end **92** of the biasing element **90** is disposed within the detent **69** of the blade **60**. A length of the deflected biasing element **90** contacts the planar lower surface **77** in this fully retracted position. It will be appreciated that the length of the biasing element **90**, as measured longitudinally across the blade cavity **26**, varies according to the deflection condition of the biasing element **90**. In other words, the straight-line distance between the first and second ends **92**, **94** is greatest when the blade **60** is in the fully retracted position, thereby causing deflection of the biasing element **90**. The biasing element **90** naturally wants to assume a curled, deflected position and thus when it is deflected, an amount of energy is stored in the biasing element **90**. In other words, when the blade **60** is closed, the biasing element **90** is placed in tension along its length because the force created by the detent **69** on ball end **92** of the biasing element **90** causes the biasing element **90** to deflect.

For purpose of simplicity only, FIGS. **5** through **7** illustrate the user grasping the blade **60** near the second, tipped portion **64** thereof; however, it will be understood that the pins **67** are intended to serve as contact points between the user's fingers and the blade **60** to assist the user in opening the blade **60**. For example, the user can engage the pins **67** with his/her fingers to exert a force (e.g., a pushing force) on the blade **60** to cause the blade **60** to lift from its retracted position and open.

The blade **60** pivots about the pin **40** as shown by the arrow **41** in FIG. **5** when the user lifts the blade in the direction of arrow **43**. The initial deflection direction of the biasing element **90** is illustrated by the arrow **45** and as can be seen, once the tension of the biasing element **90** is slowly released, the biasing element **90** deflects about the pin **96**. FIG. **5** illustrates the arcuate ridge at the first end **92** of the biasing element **90** moving along the curved surface of the detent **69** to a location where the first end **92** is just free of the detent **69** and engages the generally planar lower surface **63** of the blade **60**. This relative movement between the first end **92** and the detent **69** is caused by the user opening the blade **60** in the direction **43**.

Because the first end **92** is in the form of an arcuate ridge, the first end **92** can effectively roll against an opposing surface, such as the detent **69** and/or the planar surface **63**. Another advantage of forming the first end **92** to have arcuate features which complement the arcuate features of the detent **69** is that the first end **92** is permitted to move within the detent **69** and slide into and out of the detent **69** with some ease. Conversely, if the first end **92** and detent **69** had sharp edges, such movement would not be possible and once the first end **92** aligned with the detent **69**, the first end **92** would fall into and engage the detent **69** but would not easily become disengaged therefrom.

FIG. **6** shows further opening of the blade **60** with a first position of the blade **60** being shown in phantom and a next second position of the blade **60** being shown. As the blade **60** opens, the first end **92** of the biasing element **90** travels along the planar surface **63** as the biasing element **90** continuously deflects due to a release of the energy stored in the biasing element **90**. The deflection direction of the biasing element **90** is in the same general direction as the direction that the user is pulling the blade **60** and thus, the deflection of the biasing element **90** and its contact with the blade **60** as it deflects, actually assists the user in opening the blade **60** to the fully extended position shown in FIG. **7**. As will be described in greater detail hereinafter, once the first end **92** of the biasing element **90** clears the detent **69**, the deflection force generated by the biasing element **90** pushes the blade **60** outwardly towards the fully extended position.

As the blade **60** is opened, there comes a point where the first end **92** of the biasing element **90** becomes removed from contact with the planar surface **63** due to a number of factors, including the length of the biasing element **90**, the angle of the blade **60** relative to the lower surface **77**, the location of the pivot point (pin **40**) of the blade **60** relative to the biasing element **90**, etc. Once the first end **92** is no longer in contact, the biasing element **90** assumes its rest position, where any stored energy has been released (as best shown in FIG. **7**). The blade **60** continues to pivot about pin **40** until the blade assumes the fully extended position shown in FIG. **7**. As will be described later, the locking feature **80** engages the first end **62** of the blade **60** to effectively releasably lock the blade **60** in the fully extended position. In this fully extended position, the first end **92** of the biasing element **90** and the first end **62** of the blade **60** are spaced from one another.

FIGS. **8** through **11** illustrate the closing of the blade **60** from the fully extended position (in phantom in FIG. **8**) to the fully retracted position of FIG. **11**. To close the blade **60**, the locking feature **80** is first released, thereby permitting the blade **60** to move in a closing direction, generally indicated by arrow **51**. Once again, FIGS. **8** through **11** show the user's fingers grasping the blade **60** near the second end **64** for purpose of illustration only and it will be appreciated that the user can use pins **67** and ridged section **68** for closing the blade **60**. FIG. **8** shows an intermediate position of the blade **60**, where the blade **60** is not yet in contact with the biasing element **90**, which is in a relaxed position.

FIG. **9** shows the further closing action of the blade **60** with the blade **60** being pivoted about the pin **40** and into contact with the biasing element **90**. More specifically, the first end **92** of the biasing element **90** contacts the planar surface **63** outside of the detent **69**. As previously, mentioned, the arcuate features of the first end **92** permit the first end **92** to slide along planar surface **63** as the blade **60** is retracted. Once the blade **60** contacts the first end **92**, a force is applied against the biasing element **90** to cause deflection of first end **92** of the biasing element **90** in a direction towards the planar lower surface **77**.

The blade **60** is shown in a further closed position in FIG. **10**. In this position, the biasing element **90** is further deflected (resulting in more energy being stored therein) at the first end **92** and the arcuate ridge formed at the first end **92** remains in contact with the surface **63**. As one will appreciate the straight-line distance between the ends **92, 94** of the biasing element is greater in the condition of the biasing element in FIG. **10** compared to the condition of FIG. **9**. In other words, the biasing element **90** is being compressed to a deflected position, where the biasing element **90** is "straighter".

FIG. **11** shows the blade **60** in its fully retracted position. The exemplary folding knife **10** is configured such that the blade **60** rests in the fully retracted position even though the biasing element **90** remains deflected (compressed) in this position. This is a result of a number of characteristics that are associated with the biasing element **90** and the location of the detent **69**. More specifically and as previously-mentioned, the length of the biasing element **90** varies as it becomes more and more deflected, with the length of the biasing element **90** increasing as it further deflects. Once the biasing element **90** is fully deflected and the blade **60** is further pivoted during the closing operation, the detent **69** effectively "catches up" with the second end **92** such that when the blade **60** is completely in the closed (horizontal) position, the detent **69** effectively is aligned with the second end **92**. More specifically, after the biasing element **90** assumes the deflected position, the further pivoting of the blade **60** causes the detent **69** to rotate into engagement with the second end **92**.

Thus, the slope of the detent **69** relative to the degree of curvature of the first end **92** is such that, in the fully retracted position, the biasing element **90** generates a contact force on the blade **60** that acts generally horizontal, as indicated by the arrow **53**, and this causes a moment (torque) where the blade **60** is urged in a counter-clockwise direction. At the same time, the biasing element **90** has an upward force component; however, this upward force component is overcome by the generally horizontal contact force generated between the biasing element **90** and the blade **60**. This results in the blade **60** remaining in the closed, fully retracted position. The location of the detent **69** and the length of the biasing element **90** should be selected so that in the fully retracted position, the upward deflection force of the first end **92** is overcome by a counterforce, thereby permitting the first end **92** to seat against the blade **60** without causing a clockwise, opening motion by the blade **60**. The location of the detent **69** relative to the pivot point (i.e., pin **40**) of the blade **60** is also carefully selected such that the above-described forces result and the blade **60** remains in the closed position.

In order for the upward force component of the biasing element **90** to overcome the generally horizontal force component, the length of the biasing element **90** must decrease; however, the seating position of the first end **92** within the detent **69** does not permit such length reduction. However, once the user lifts the blade **60** slightly and begins to pull the blade **60** in a clockwise direction, the first end **92** is freed from its static position within the detent **69** and is free to move within the detent **69**. Accordingly, the length of the biasing element **90** can now decrease and as it decreases, the first end **92** tracks along the sloped surface of the detent **69**. As the first end **92** moves along the detent **69**, the horizontal force component is reduced or eliminated, thereby resulting in the upward force component being the predominant force component generated by the biasing element **90**. This upward deflection force continues as the first end **92** clears and is free from the detent **69** and contacts the surface **63**. In other words, once the first end **92** is removed from the position where the upward deflection force is the inferior force and is placed in a position where the upward deflection force is the superior force, the natural deflection of the biasing element **90** acts against the blade **60** to cause a clockwise rotation of the blade **60** about the pivot **40**.

In one exemplary embodiment, the biasing element **90** comprises a an elongated spring element; however, it will be understood that a number of different springs having different configurations can be used, e.g., a leaf spring, so long as the spring functions in the manner described hereinbefore.

The biasing element **90** is thus configured to assist the user in opening the blade **60** by applying a force (in the clockwise direction) to the blade **60**. The biasing element **90** thus provides a very simple yet effective mechanism for assisting the user in opening the blade **60**. This overcomes the disadvantage of conventional folding knives in which a significant amount of force is needed to pull the blade from the fully retracted position to a fully extended position. For some individuals, the opening of the blade can be a difficult task and thus, the present arrangement provides a folding knife which can be used easily by a larger number of the consumers.

Referring to FIGS. **6–11**, the second inner handle plate **110** has an automatic locking feature **80** that serves to releasably lock the blade **60** in the fully extended position. FIG. **7** shows the locking feature **80** engaging the blade **60** so as to effectively lock the blade **60** in the fully extended position. The operation of the locking feature **80** is best illustrated in reference to FIGS. **6** through **11**. The locking feature **80** is formed near the first end **112** of the second inner handle plate **110** opposite the second end **114** which is fixed in position. The first end **112** aligns with the first end **42** of the second handle member **24** (FIG. **1**); however the locking feature **80** is formed prior to the first end **112** and is constructed so as to permit a portion of the second inner plate **110** to be flexedly biased proximate to the pivotal first end **62** of the blade **60**.

The locking feature **80** is constructed so that it is a biased member (e.g., a tongue like member) that is formed as part of the second handle plate **110** with the locking feature **80** being positionable between a lock position and an unlock position. Because the locking feature **80** is formed as part of the second inner handle plate **110**, the locking feature **80** extends a length of the blade cavity **26** and as shown in the Figures, and the locking feature **80** extends along the blade cavity **26** on one side of the biasing element **90**.

The locking feature **80** is formed by altering the construction of the second inner handle plate **110** so as to create a biased tongue that flexes inwardly and outwardly near the first end **62** of the blade **60** depending upon the position of the blade **60**. For example, the locking feature **80** (biased tongue) can be formed by forming one or more openings **81**

and one or more slots **83**, to create the biasing characteristics of the locking feature **80**. The locking feature **80** has a locking surface **82** that preferably has a complementary surface profile as the first end **62** of the blade **60** (as shown in FIG. **7**) so that the locking surface **82** becomes flexedly displaced in the blade cavity **26** and seats against or at least along the axis of rotation of the blade **60**. The locking surface **82** is actually an end of the biased tongue-like structure **80** and thus the locking surface **82** creates interference with the blade **60** and prevents pivoting movement of the blade **60** once the locking feature **80** assumes this locked position. This acts as a safety mechanism in that the blade **60** is prevented from freely pivoting out of the fully extended position (the position where the knife is being used in some capacity) even if the blade **60** contacts an object and/or a force is applied to the blade **60** in a direction that normally would pivot the blade **60**.

The locking feature **80** is constructed so that in the normal rest position, the locking feature **80** assumes a deflected position where the locking surface **82** flexes inwardly into the blade cavity **26** and into a position where the aforementioned interference is created between the locking surface **82** and the blade **60**. In other words, the locking feature **80** is naturally biased so that it assumes a position with the locking feature **80** (and locking surface **82**) being inwardly deflected unless some interference is created to prevent the locking feature **80** from assuming this deflected position. When the blade **60** is in the retracted position (FIG. **4**) and when the blade **60** is being pivotally opened, the blade **60** itself creates the interference with the locking feature **80** that prevents the locking feature **80** from assuming the deflected position. This interference results because the feature **80** is formed as part of the second inner handle plate **110** that is axially disposed on one side of the blade **60**.

The locking feature **80** has a roughened surface profile **87** at an upper edge thereof near the locking surface **82** to assist the user in disengaging the locking feature **80** from its locked position and thereby free the blade **60** for pivoting movement. To move the locking feature **80** from the locked position to the unlocked position, the user simply contacts the profile **87** and applies a force in the direction towards the second handle member **24**, thus causing the locking feature **80** to flex outwardly. In other words, the user overcomes the biasing force by applying a greater force in an opposite direction as the direction of the biasing force. The locking surface **82** disengages from the first end **62** of the blade **60**, thereby permitting the blade **60** to pivotally rotate about **40** and into the blade cavity **26**. Once the locking feature **80** is removed from the axis of rotation of the blade **60**, the blade **60** can freely pivot into the cavity **26** where it then makes contact with the biasing element **90** as previously described. Once the first end **62** of the blade **60** is pivoted a predetermined amount, it becomes disposed within the cavity **26** so as to prevent the locking feature **80** from flexing inwardly and therefore, the user can remove the applied force to the locking feature **80**. The locking feature **80** will likely flex slightly inward once the applied force is removed; however, the locking feature **80** will encounter the first end **62** of the blade **60**, which prevents its further inward flexing, while permitting the blade **60** to continue to pivotally rotate.

The present folding knives thus provide reliable, easy to use folding knives that each includes a biased blade to assist the user in opening the blade and also a locking feature that is biased such that it automatically locks the blade when the blade is opened.

While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and details may be made therein without departing from the spirit and scope of the invention.

What is claimed is:

1. A folding knife comprising:

a handle defining a blade cavity;

a blade having a first end which is pivotably coupled to the handle about a pivot and a second end which includes a sharpened edge, the blade pivoting about the pivot between a retracted position where the blade is substantially within the blade cavity and an extended position where the blade is substantially outside of the blade cavity, the blade having a detent formed therein on a lower edge thereof proximate to the pivot; and

a biasing element disposed within the blade cavity of the handle, the biasing element having a fixed first end and an opposing free second end which has a profile, wherein as the blade is closed towards the retracted position, the blade deflects the second end of the biasing element until the profile of the second end engages and is retained within the blade detent, resulting in the blade being held in the retracted position, and wherein as the blade is pivotably opened, the profile of the second end becomes disengaged from the detent and energy stored in the deflected biasing element is released and directed into a biasing force that pivots the blade towards the extended position, thereby assisting a user in opening the blade.

2. The folding knife of claim **1**, wherein the handle includes a core member defining a lower surface of the blade cavity and at least one handle member disposed on each side of the core.

3. The folding knife of claim **2**, wherein the blade pivot extends through the handle members and the core at one end thereof.

4. The folding knife of claim **1**, wherein the blade pivot comprises a pin extending across the blade cavity of the handle, the blade being pivotably rotated about the pin.

5. The folding knife of claim **1**, wherein the blade includes a pair of opposing pins extending outwardly from an outer surface of the blade proximate the first end of the blade.

6. The folding knife of claim **1**, wherein the detent comprises a notch formed in the lower surface of the blade.

7. The folding knife of claim **6**, wherein the notch has an arcuate shape.

8. The folding knife of claim **2**, wherein the biasing element is disposed between the blade and the lower surface of the blade cavity.

9. The folding knife of claim **1**, wherein the biasing element comprises an elongated leaf spring.

10. The folding knife of claim **1**, wherein the first end of the biasing element is fixed by a pin.

11. The folding knife of claim **1**, further including:

a retaining pin disposed above the biasing element but below the blade, the retaining pin limiting upward movement of the biasing element while creating a pivot point about which the biasing element pivots.

12. The folding knife of claim **1**, wherein the profile of the second end of the biasing element comprises an arcuate ridge.

13. The folding knife of claim **1**, wherein the biasing element generates in the retracted position a deflection force which is less than or equal to a contact force generated between the second end of the biasing element and the detent of the blade resulting in the blade remaining in the retracted position.

14. The folding knife of claim **13**, wherein the deflection force is generated in a direction away from a lower internal

surface of the handle, the biasing element being disposed between the lower surface and the blade.

15. The folding knife of claim **1**, wherein the second end of the biasing element has a shape complementary to a shape of the detent to permit reception and retention of the second end within the detent.

16. The folding knife of claim **13**, wherein the detent has a first sloped section such that in the retracted position, the second end of the biasing element is urged against the sloped section, thereby generating the contact force.

17. The folding knife of claim **1**, wherein in the retracted position, a length of the biasing element between the first and second ends seats against a lower internal surface of the handle.

18. The folding knife of claim **1**, further including:

a locking member formed as part of the handle, the locking member automatically biased to the locking position once the blade pivotally clears a locking surfaces of the locking member as the blade is pivotally opened.

19. The folding knife of claim **18**, wherein the locking member comprises a biased tongue defined by a slot formed in an inner handle plate that defines one side of the blade cavity and is a part of the handle.

20. The folding knife of claim **1**, wherein the biasing element pivots in a counter clockwise direction and the blade pivots in a clockwise direction when the blade is opened from the retracted position.

21. The folding knife of claim **1**, wherein the second end of the biasing element contacts and applies biasing force against a section of the lower surface of the blade extending between the detent and the first end of the blade.

22. A folding knife comprising:

a handle defining a blade cavity;

a blade having a first end which is pivotably coupled to the handle about a pivot and a second end, the blade pivoting about the pivot between a retracted position where the blade is substantially within the blade cavity and an extended position where the blade is substantially outside of the blade cavity, the blade having a detent formed therein on a lower edge thereof proximate to the pivot; and

a biasing element disposed within the blade cavity of the handle, the biasing element having a fixed first end and an opposing free second end which has a rounded ball member formed thereat, wherein as the blade is closed towards the retracted position, the blade contacts and deflects the second end of the biasing element until the rounded ball member of the second end engages the blade detent, resulting in the blade being held in the retracted position due to a contact force being generated between the rounded ball member and at least one surface of the detent, and wherein as the blade is pivotably opened, the rounded ball member of the second end slides out of engagement with the detent and energy stored in the deflected biasing element is released and directed into a biasing force against the blade causing the blade to pivot towards the extended position, thereby assisting a user in opening the blade.

23. A folding knife comprising:

a handle defining a blade cavity;

a blade having a first end which is pivotably coupled to the handle about a pivot and a second end which includes a sharpened edge, the blade pivoting about the pivot between a retracted position where the blade is substantially within the blade cavity and an extended position where the blade is substantially outside of the blade cavity, the blade including a receiving feature formed therein along one edge thereof proximate to the second end; and

a biasing element disposed within the blade cavity of the handle, the biasing element having a fixed first end and an opposing free second end which has an engaging feature formed thereat such that as the blade is closed towards the retracted position, the blade deflects the second end of the biasing element causing the engaging feature to travel along the one edge until it engages and is retained within the receiving feature, resulting in the blade being held in the retracted position, and wherein as the blade is pivotably opened, the engaging feature clears the receiving feature and energy stored in the deflected biasing element is released and directed against the blade as a biasing force that pivots the blade towards the extended position, thereby assisting a user in opening the blade.

24. The folding knife of claim **23**, wherein the engaging feature comprises a rounded protrusion formed at the second end.

25. The folding knife of claim **23**, wherein the receiving feature comprises a curved notch formed in a lower edge of the blade.

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